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Research Article

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A Longevity Study of Geriatric Index versus Four Metabolic Disorders Using Viscoplastic Energy Model of GH-Method: Math-Physical Medicine (No. 1033, Viscoelastic Medicine Theory #431)

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Abstract

One of the author's 2019 publication, paper number 113, examined the relationship between geriatrics and metabolism. The abstract of paper number 113 is also featured in the introduction section of this current paper, number 1033.

*In a subsequent study, the author has further explored the same subject, **introducing a new longevity metric called the geriatric index (GI)**, which also integrates his collected personal data spanning from 2015 to 2024, encompassing a 10-year period. Furthermore, the author applied an energy model based on the space-domain viscoplastic medicine theory (SD-VMT) to generate quantitative insights into the relationships between GI and four metabolism parameters: body weight (m1), glucose (m2), blood pressure (m3), and blood lipids (m4). The findings from his collected data, averaged over the past decade, indicate that his blood lipids are typically better controlled than blood pressure, with blood pressure being better controlled than glucose, and glucose showing better control than his body weight.*

The geriatric index (GI) encompasses six key lifestyle factors and health age, which are defined as follows:

Geriatric Index
= (health age + averaged lifestyle details) / 2

Health Age
= Chronological real Age *
(1+((MI-0.735)/0.735)/2)

Averaged Lifestyle Details
= (exercise m5 + water drinking m6 + sleep m7 + stress m8
+ diet portion and quality m9 + daily life routine regularity m10) / 6

where MI is the metabolism index calculated using 500 detailed elements of 4 categories of medical conditions and 6 categories of lifestyle details.

***In summary,** the four energy ratios of his geriatric index (GI) between Y2015 and Y2024 are:*

M1 (body weight) = 30%
M2 (glucose) = 28%
M3 (blood pressures) = 25%
M4 (blood lipids) = 18%

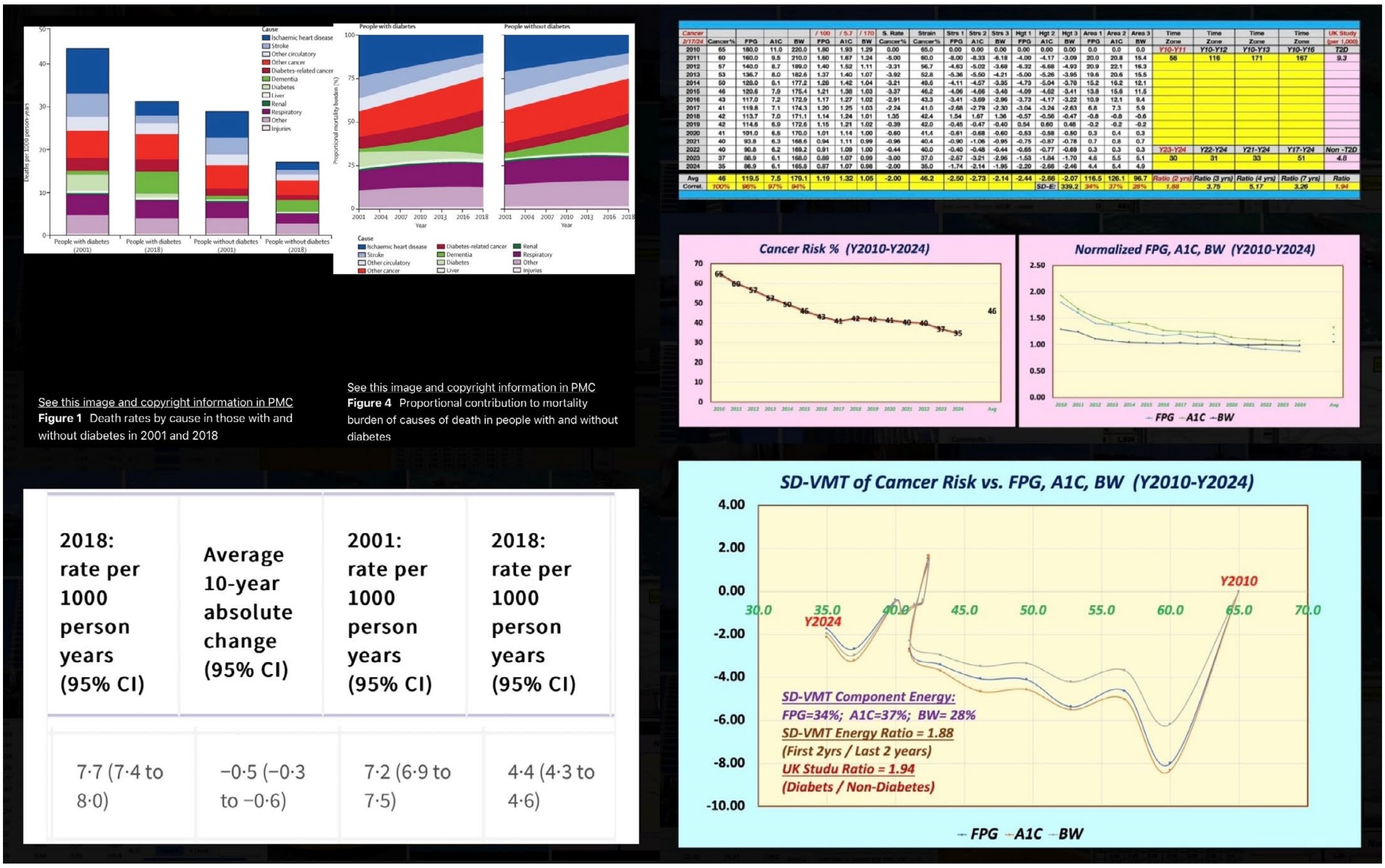
Where: ***M1 > M2 > M3 > M4***

The time-zone energy distributions are:

Y2015-Y2019 = 46%
Y2020-Y2024 = 54%

The recent period from Y2020 to Y2024 has a slightly greater impact on his longevity, contributed from 4 metabolic categories, compared to the earlier period of Y2015 to Y2019.

Key Message
For a patient with long-term metabolic disorders, such as the author himself, maintaining optimal control over his body weight and glucoses within healthy limits is crucial for achieving longevity goals.



1. Introduction

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In a subsequent study, the author has further explored the same subject, ***introducing a new longevity metric called the geriatric index (GI),*** which also integrates his collected personal data spanning from 2015 to 2024, encompassing a 10-year period. Furthermore, the author applied an energy model based on the space-domain viscoplastic medicine theory (SD-VMT) to generate quantitative insights into the relationships between GI and four metabolism parameters: body weight (m1), glucose (m2), blood pressure (m3), and blood lipids (m4). The findings from his collected data, averaged over the past decade, indicate that his blood lipids are typically better controlled than blood pressure, with blood pressure being better controlled than glucose, and glucose showing better control than his body weight.

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1.1 Biomedical and Engineering or Technical information

The following sections contain excerpts and concise information on meticulously reviewed by the author of this paper. The author has adopted this approach as an alternative to including a conventional reference list at the end of this document, with the intention of optimizing his valuable research time. It is essential to clarify that these sections do not constitute part of the author's original contribution but have been included to aid the author in his future reviews and offer valuable insights to other readers with an interest in these subjects.

2. Pathophysiological Explanations of Longevity and 4 Metabolism Categories, Weight, Glucose, Blood Pressure, and Blood Lipids

There are several pathophysiological explanations for the relationship between longevity and the four metabolism categories: body weight, glucose, blood pressure, and blood lipids.

2.1 Body Weight

Maintaining a healthy weight is associated with decreased risk of various health conditions such as cardiovascular disease, diabetes, and certain cancers. Excessive weight, particularly visceral adiposity, can contribute to chronic low-grade inflammation, insulin resistance, and metabolic dysfunction, thus increasing the risk of developing age-related diseases and reducing longevity (Note: That is why the author started his resistance training since 1/1/2024. Within the coming three years, he intends to reduce his waistline from 34 inches to 31 inches and his visceral fat ratio from 16% (now, 90% of this total body fat ratio of 18%) to 13% by 12/31/2026.)

2.2 Glucose Metabolism

Dysregulation of glucose metabolism, as seen in conditions such as diabetes and insulin resistance, can lead to an increased risk of heart disease, stroke, kidney disease, and other complications. Chronically elevated blood glucose levels can contribute to endothelial dysfunction, oxidative stress, and accelerated aging processes.

2.3 Blood Pressure

Hypertension (high blood pressure) is a major risk factor for cardiovascular disease, stroke, and other adverse outcomes. Sustained high blood pressure can cause damage to blood vessels, the heart, and other organs, leading to reduced longevity.

2.4 Blood lipids

Elevated levels of LDL cholesterol and triglycerides, along with reduced levels of HDL cholesterol, are associated with an increased risk of atherosclerosis, cardiovascular disease, and related complications. These lipid abnormalities can contribute to the development of plaques in the arteries, increasing the risk of heart attacks and strokes, and potentially shortening lifespan.

Longevity is influenced by a complex interplay of genetic, lifestyle, and environmental factors. Additionally, the pathophysiological mechanisms underlying these metabolic categories are interconnected and may collectively contribute to overall health and longevity. Strategies such as maintaining a healthy diet, engaging in regular physical activity, managing stress, and avoiding smoking and excessive alcohol consumption can positively impact these metabolic parameters and potentially promote longevity.

3. MPM Background

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 (Reference 1) describes his MPM methodology in a general conceptual format. The second paper, No. 387 (Reference 2) outlines the history of his personalized diabetes research, various application tools, and the differences between biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 (Reference 3) depicts a general flow diagram containing ~10 key MPM research methods and different tools.

4. The Author'S Diabetes History

The author was a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with an average daily glucose of 250 mg/dL (HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 to develop a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average finger-piercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes-related medications since 12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period, including both 2018 and 2019, he traveled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his glucose control was somewhat affected during the two-year traveling period of 2018-2019.

He started his COVID-19 self-quarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lbs. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special

COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-traveling, low-stress, and regular daily life routines. Of course, his in-depth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his own developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checks his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5-minute intervals from every 15-minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work over 40,000 hours and read over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with well-balanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time-length depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

5. Energy Theory

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells; and energy consumption from labor-work or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucoses are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g. diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For an example, the combination of hyperglycemia and hypertension would cause micro-blood vessel's leakage in kidney systems which is one of the major cause of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. ***Both output symptom value (i.e. strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) are influencing the energy level (i.e. the Y-amplitude in the frequency domain).***

Currently, many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deform; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, the carbohydrates and sugar function as the energy supply. After having labor work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both processes of energy influx and energy dissipation take some time which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviors are "dynamic" in nature, i.e. time-dependent. *This time-dependent nature leads to a "viscoelastic or viscoplastic" situation.* ***For the author's case, it is "viscoplastic" since most of his biomarkers are continuously improved during the past 13-year time window.***

Time-dependent output strain and stress of (viscous input*output rate)

Hooke's law of linear elasticity is expressed as:
Strain (ε: epsilon)
= Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:
PPG (strain) = carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking k-steps * GH.w-Modulus (a negative number)

Where GH.p-Modulus is reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:
Stress
= viscosity factor (η: eta) * strain rate (dε/dt)

Where strain is expressed as Greek epsilon or ε.

In this article, in order to construct an "ellipse-like" diagram in a stress-strain space domain (e.g. "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain
= (body weight at certain specific time instant)

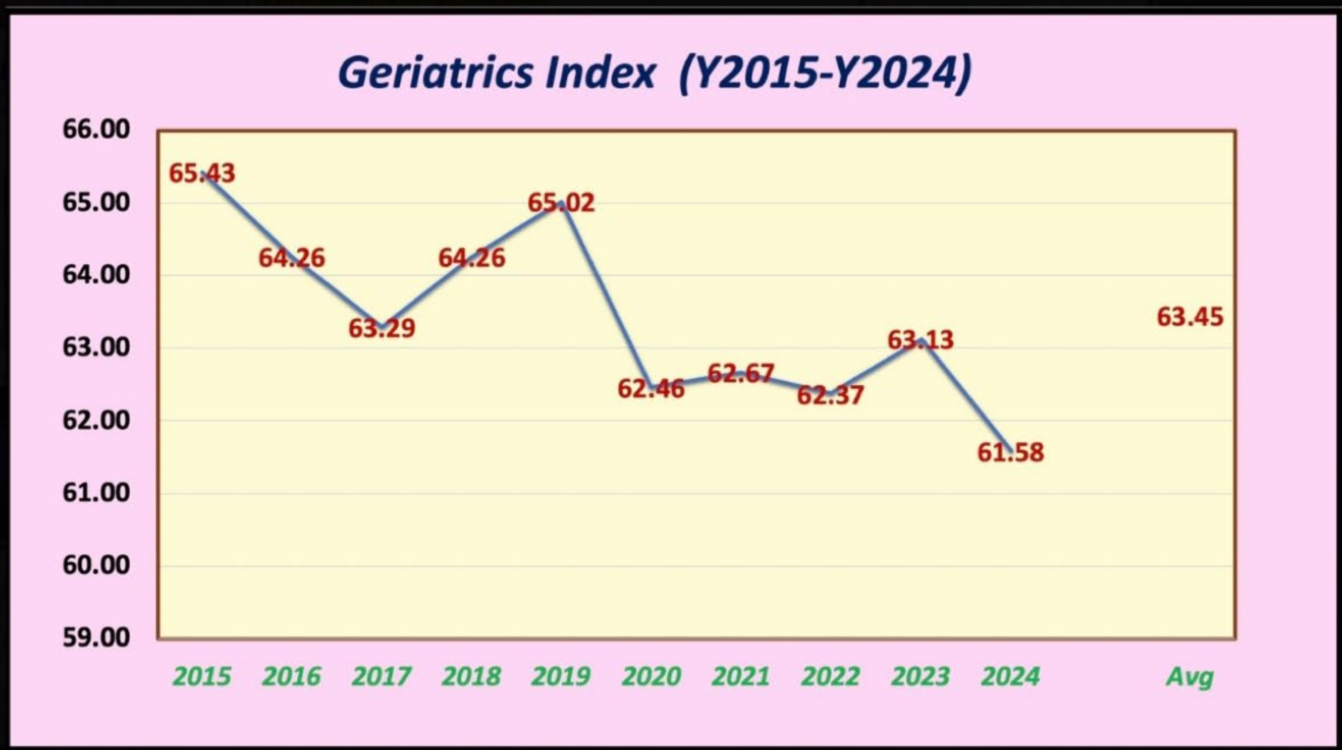
He also calculates his strain rate using the following formula:

Strain rate
= (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorder-induced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of explored deadly diseases and longevity characteristics using the ***viscoplastic medicine theory (VMT)*** include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect ***based on time-dependent stress and strain*** which are different from his previous research findings using ***linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).***

6. Results



Geriatrics	Index (GI)		
2/16/24	Avg. LD	H.Age/10	GI
2015	0.67	0.6386	65.43
2016	0.66	0.6252	64.26
2017	0.64	0.6258	63.29
2018	0.65	0.6351	64.26
2019	0.65	0.6504	65.02
2020	0.62	0.6291	62.46
2021	0.61	0.6433	62.67
2022	0.60	0.6474	62.37
2023	0.60	0.6625	63.13
2024	0.58	0.6516	61.58
Avg.	0.6280	0.6409	63.45

Geriatrics						/ 1	/ 1	/ 1	/ 1	S. Rate	Strain
2/16/24	GI	M1	M2	M3	M4	M1	M2	M3	M4	GI	GI
2015	65.43	1.05	1.07	0.93	0.68	1.05	1.07	0.93	0.68	0.00	65.43
2016	64.26	1.02	1.00	0.85	0.58	1.02	1.00	0.85	0.58	-1.17	64.26
2017	63.29	1.04	0.98	0.84	0.43	1.04	0.98	0.84	0.43	-0.97	63.29
2018	64.26	1.02	0.97	0.85	0.40	1.02	0.97	0.85	0.40	0.97	64.26
2019	65.02	1.02	0.95	0.90	0.71	1.02	0.95	0.90	0.71	0.76	65.02
2020	62.46	1.01	0.89	0.81	0.60	1.01	0.89	0.81	0.60	-2.56	62.46
2021	62.67	1.00	0.87	0.88	0.87	1.00	0.87	0.88	0.87	0.21	62.67
2022	62.37	1.01	0.86	0.91	0.85	1.01	0.86	0.91	0.85	-0.30	62.37
2023	63.13	1.00	0.84	0.94	0.63	1.00	0.84	0.94	0.63	0.76	63.13
2024	61.58	0.98	0.88	0.89	0.79	0.98	0.88	0.89	0.79	-1.55	61.58
Avg	63.45	1.02	0.93	0.88	0.65	1.02	0.93	0.88	0.65	-0.39	63.45
Correl.	100%	77%	81%	18%	-37%						

Geriatrics	Strs 1	Strs 2	Strs 3	Strs 4	Hgt 1	Hgt 2	Hgt 3	Hgt 4	Area 1	Area 2	Area 3	Area 4	Time
2/16/24	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	Zone
2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Y15-Y19
2016	-1.19	-1.17	-0.99	-0.68	-0.60	-0.59	-0.50	-0.34	0.70	0.68	0.58	0.40	8.1
2017	-1.01	-0.95	-0.81	-0.42	-1.10	-1.06	-0.90	-0.55	1.07	1.03	0.88	0.53	46%
2018	0.99	0.94	0.82	0.39	-0.01	0.00	0.00	-0.01	-0.01	0.00	0.00	-0.01	
2019	0.78	0.72	0.68	0.54	0.88	0.83	0.75	0.46	0.67	0.63	0.57	0.35	
2020	-2.59	-2.28	-2.07	-1.54	-0.91	-0.78	-0.69	-0.50	2.32	1.99	1.78	1.28	Y20-Y24
2021	0.21	0.18	0.18	0.18	-1.19	-1.05	-0.94	-0.68	-0.25	-0.22	-0.20	-0.14	9.4
2022	-0.30	-0.26	-0.27	-0.26	-0.05	-0.04	-0.04	-0.04	0.01	0.01	0.01	0.01	54%
2023	0.76	0.64	0.71	0.48	0.23	0.19	0.22	0.11	0.17	0.14	0.17	0.09	
2024	-1.52	-1.36	-1.38	-1.22	-0.38	-0.36	-0.33	-0.37	0.59	0.56	0.52	0.58	
Avg	-0.39	-0.35	-0.31	-0.25	-0.31	-0.29	-0.24	-0.19	5.3	4.8	4.3	3.1	
Correl.							SD-E:	17.5	30%	28%	25%	18%	

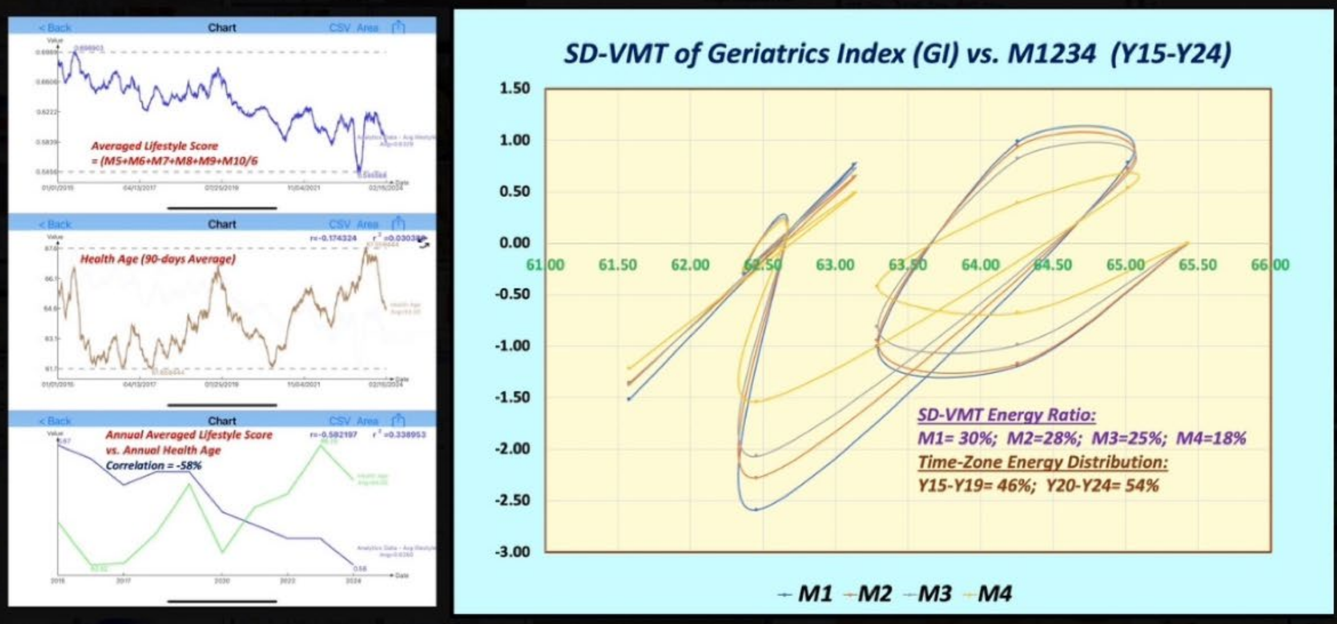


Figure 1. Shows Data table, TD and SD results.

7. Conclusions

In summary, the four energy ratios of his geriatric index (GI) between Y2015 and Y2024 are:

M1 (body weight) = 30%
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References

For editing purposes, majority of the references in this paper, which are self-references, have been removed for this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

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